

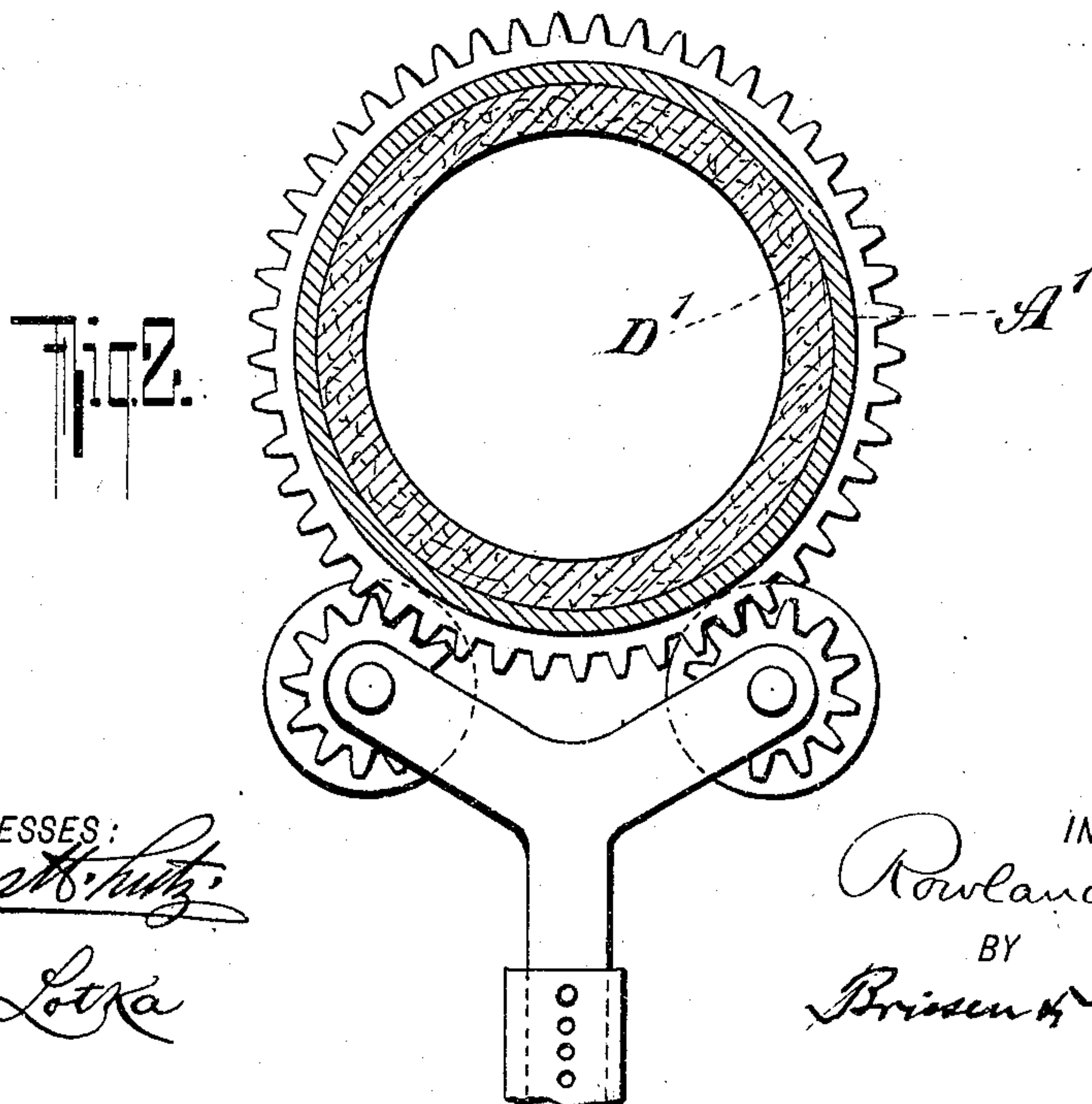
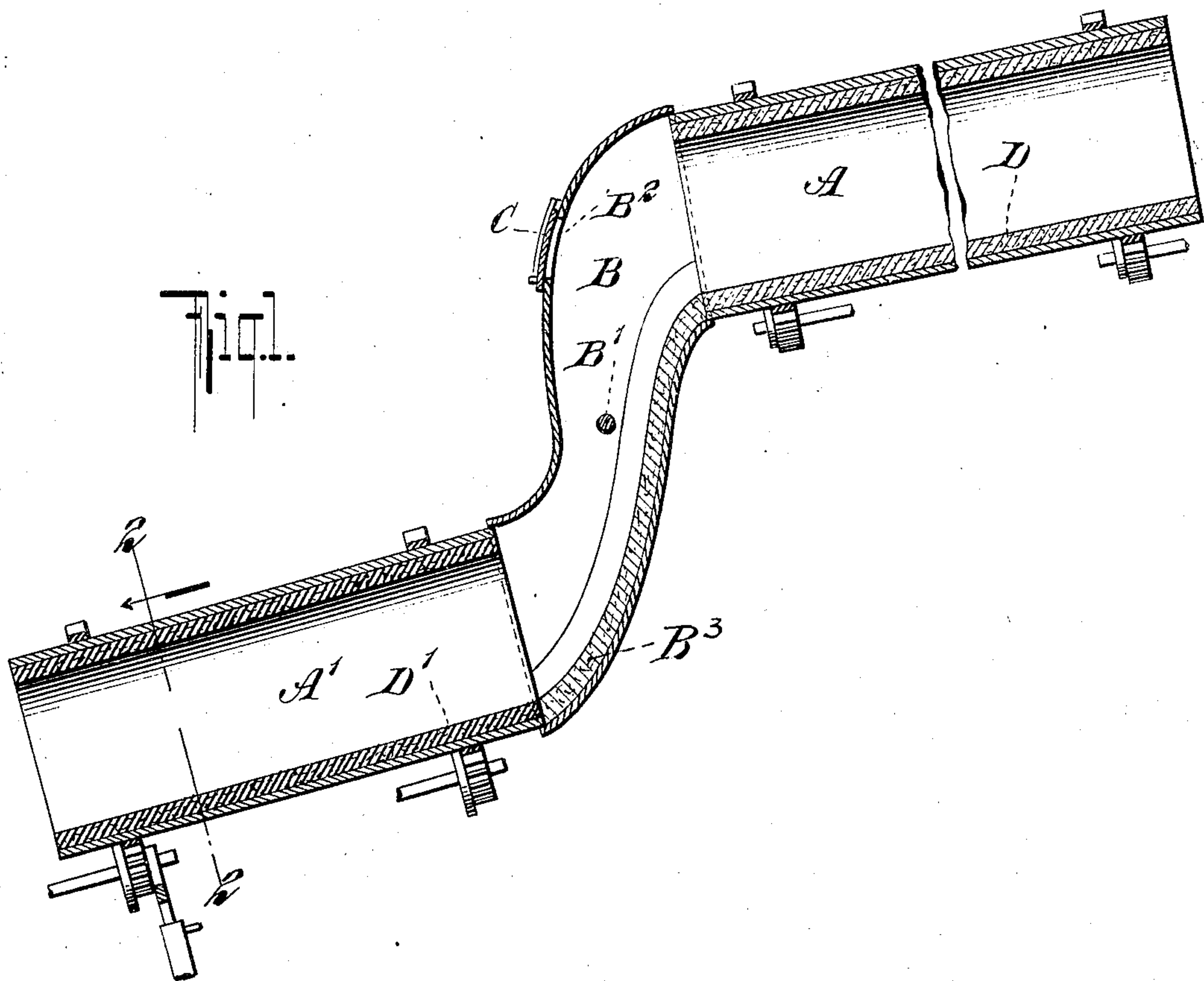
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PATENTED MAR. 19, 1907.

R. F. HILL.

APPARATUS FOR DESULFURIZING AND AGGLOMERATING PYRITES CINDER, &c.

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WITNESSES:  
*Julius H. Hutz*  
*John Lotka*

INVENTOR  
*Rowland F. Hill*  
BY  
*Brisson & Mauts*  
ATTORNEYS



# UNITED STATES PATENT OFFICE.

ROWLAND F. HILL, OF NEW YORK, N. Y., ASSIGNOR TO GENERAL CHEMICAL COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

APPARATUS FOR DESULFURIZING AND AGGLOMERATING PYRITES-CINDER, &c.

No. 847,410.

Specification of Letters Patent.

Patented March 19, 1907.

Application filed December 20, 1905. Serial No. 292,557.

*To all whom it may concern:*

Be it known that I, ROWLAND F. HILL, a citizen of the United States, and a resident of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Apparatus for Desulfurizing and Agglomerating Pyrites-Cinder and the Like, of which the following is a specification.

Pyrites-cinder and other pulverulent metal-bearing materials on account of their dust-like nature have been incapable of being treated in the same manner as ordinary crushed or lumpy ore. To recover the metal from such pulverulent materials, it has been proposed to subject them to a desulfurizing and agglomerating treatment, whereby they are formed into coherent lumps, masses, or nodules, which may then be treated in a blast-furnace or otherwise. This desulfurizing and agglomerating treatment has been carried out in an inclined rotary kiln, and in the practical working of the process serious difficulties have been encountered on account of the tendency of the pasty or semifused mass to adhere mechanically to the lining of the kiln or to adhere thereto by combining chemically with the kiln-lining.

The object of my invention is to avoid the sticking of the material to the kiln-lining either mechanically or chemically and to do this without either injuring the kiln-lining or interrupting the operation of the process.

In the accompanying drawing I have shown in Figure 1 a longitudinal section of an apparatus suitable for the purposes of my invention, and in Fig. 2 a cross-section thereof on line 2 2 of Fig. 1.

There are two rotary kilns or drums A and A', respectively, both inclined and one arranged at a higher level than the other. The kilns may be arranged stepwise, as shown, and in the same vertical plane. Both kilns may have the same inclination, or the lower kiln may be inclined more steeply, and the lower end of the lower kiln may be adjusted vertically, so as to vary the inclination. Any suitable mechanism may be employed for rotating the kilns, the means for rotating the lower kiln being preferably independent, so that the speed of one kiln may be varied without affecting that of the other. The

upper kiln will as a rule be considerably longer than the lower kiln.

The connection between the two kilns is effected in any suitable manner. I have shown a connecting-pipe B, pivoted at B' and adapted to have its ends abut against the adjacent ends of the two kilns. This pipe may be provided with a valve or damper either simply controlling the connection from one kiln to the other or, preferably, the valve or damper C controls an air-inlet B<sup>2</sup>, as shown.

The upper kiln A has a lining D of ordinary fire-brick or any other suitable material; but the lining D' of the lower kiln A' should be basic or at least neutral—that is, non-acid. Such lining may be made, for instance, of chrome, magnesite, beauxite, carborundum, or steel brick.

In operation the pyrites-cinder or other pulverulent material is fed at the upper end of the upper kiln A, while the fuel (as a coal-dust flame) enters at the lower end of the lower kiln A'. The hot gases pass through the two kilns and the connecting-pipe B, the temperature increasing as the ore or like material approaches the lower end of the lower kiln. Within the upper kiln A the temperature should be sufficient to desulfurize the ore, but not high enough to melt the sulfid or cause the ore to sinter into lumps. In the lower kiln A' the temperature is sufficient to produce superficial fusion of the desulfurized material, and on account of the agitation produced by the rotation of the kiln the partly-fused material will form coherent lumps or nodules, the size of which will depend on the inclination of the lower kiln A' and also on the speed with which it is rotated.

Since I use a basic or neutral lining in the lower kiln, there is no danger of a chemical combination occurring between the ore and the kiln-lining. I thus prevent erosion or destruction of the lining and also the sticking of the fused mass to the kiln, owing to chemical reactions. Still it is possible that in some cases the fused material might adhere to the lining of the lower kiln mechanically. If this should happen, the remedy would be the application of an increased heat in the lower kiln, so as to melt the adhering mass away from the kiln-lining. Of course this



increase of heat in the lower kiln should not be accompanied by any increase of heat in the upper kiln sufficient to fuse or partly fuse any material therein.

5 The length of the connecting-pipe B will allow the heat to become partly dissipated or, in other words, the temperature at the upper end of the pipe B will always be below that at the lower end of the pipe, so that up  
10 to a certain point the temperature may be increased in the lower kiln above the point of fusion without reaching this point in the upper kiln. If it should be necessary to increase the temperature beyond this point to  
15 melt an obstruction formed by the adhesion of fused material to the lining of the lower kiln, special means will have to be employed to prevent the increase of heat from causing the fusion-point to be reached in the upper  
20 kiln. Thus in the example shown the valve or damper C will be opened more or less, causing a greater or smaller amount of air to be admitted at B<sup>2</sup> and to be mixed with the  
25 to the desired point. This valve or damper will be opened partly or entirely whenever the temperature is too high at the upper end of the connecting-pipe B.

30 The rotation of the upper kiln agitates and turns over the material so as to thoroughly desulfurize it by the action of the heated gases. As the temperature will always be so regulated as to prevent fusion of the material in the upper kiln, a very thorough desulfurization will be obtained, and there will be  
35 no danger of obstructions forming in the upper kiln.

40 In the lower kiln agglomeration will take place under perfect control, as the inclination and speed of this kiln may be varied without affecting the desulfurizing process going on in the upper kiln. Obstructions cannot be formed by chemical interaction between the lower-kiln lining and the material, since the lining is non-acid, as above set  
45 forth. Should any obstructions be formed by mechanical adhesion, they can readily be removed without any injury to the lining by

temporarily increasing the heat. This will not, however, necessitate any interruption of 50 the process.

The connecting-pipe B can be swung away from the kiln ends, thus greatly facilitating the making of repairs. I prefer to provide a lining B<sup>3</sup> in the connecting-pipe B, or at least 55 in the lower portion thereof, such lining being non-acid—that is, basic or neutral, similarly to the lining D'. In some cases if the suction at the opening B<sup>2</sup> should not be sufficient to admit a proper amount of cool air I 60 might employ a blower or like device to force a proper amount of air through said opening.

While my present application describes certain improvements both in the process and in the apparatus for the purpose indi- 65 cated, the claims cover only the apparatus, the process claims being contained in another application, filed June 26, 1906, Serial No. 323,437.

I claim as my invention— 70

1. An apparatus for the treatment of pyrites-cinder and other pulverulent material, comprising two inclined rotary kilns the lower one of which has a non-acid lining, and a connecting-pipe extending from one kiln to 75 the other.

2. An apparatus for the treatment of pyrites-cinder and other pulverulent material, comprising two inclined rotary kilns arranged tandemwise and a movable connecting-pipe 80 interposed between said kilns.

3. An apparatus for the treatment of pyrites-cinder and other pulverulent material, comprising two inclined rotary kilns arranged tandemwise, and a connecting-pipe inter- 85 posed between said kilns and pivoted so as to be capable of swinging toward and away from the adjacent ends of said kilns.

In testimony whereof I have hereunto signed my name in the presence of two sub- 90 scribing witnesses.

ROWLAND F. HILL.

Witnesses:

JOHN LOTKA,

JOHN A. KEHLENBECK.